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JOURNAL OF
THE TRANSACTIONS
OF
The Victoria Institute,
OR,
Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY.

VOL. VIII.



LONDON:
(Published for the Institute)
ROBERT HARDWICKE, 192, PICCADILLY, W.
1875.

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ORDINARY MEETING,* FEBRUARY 16TH, 1874.

C. BROOKE, ESQ., F.R.S., VICE-PRESIDENT, IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

ASSOCIATES :—Rev. J. M. H. Du Pontet de la Harpe, B.D., Pastor of the Frnch Evangelical Church, 16, Kildare Gardens ; Nicholas Whitley, C.E., F.M.S., Penarth, Truro.

Also, the presentation of the following Works to the Library :—

- “Proceedings of the Royal Society.” Part 149. *From the Society.*
 “Proceedings of the Smithsonian Institute for 1871.” *From the Institute.*
 “Revelation and Science.” By the Rev. P. Onslow.
From the Rev. I. G. Smith, D.D.
 “Duration of Future Punishments.” By Rev. J. Constable.
From L. Biden, Esq.
 “Hades.” By the same. *Ditto.*
 “L’Architecture du Monde des Atomes.” *From J. E. Howard, Esq.*
 “Bach’s Answer to Davison on the Johannian Gospel.”

The following Paper was then read by the Author :—

THE BRIXHAM CAVERN AND ITS TESTIMONY TO THE ANTIQUITY OF MAN;—EXAMINED. By N. WHITLEY, Esq., C.E., Hon. Sec. of the Royal Institution of Cornwall.

THERE are two lines of speculative scientific research recently promulgated by some few leading men of science, both of which aim at establishing the existence of man in times of remote antiquity. The theory of evolution, which professes to trace up man’s descent from the lowest form of marine life

* Specially an Ordinary Meeting.

through higher and yet more highly organized beings, to the "man-like apes," and from them across an unmeasured and unmeasurable gulf to man in his lowest estate as a bestial savage. The other theory attempts to trace intellectual man backwards through successive stages of degradation and savagery to the "first being worthy of being called a man." At this point these two lines of research meet: they are supposed mutually to support each other, and the origin of man is thus assumed to be accounted for.

The discovery of a new and intact Bone-cave at Windmill Hill, Brixham, in 1858, is said to have given a great impulse to these theories of man's origin, and it was decided to have a thorough and systematic examination of its contents. The Royal Society made two grants of one hundred pounds each towards defraying the expenses, on condition that the relics discovered should be deposited for inspection in the British Museum;* "a committee of geologists was charged with the investigations, amongst whom Mr. Prestwich and Dr. Falconer took an active part, visiting Torquay while the excavations were in progress under the superintendence of Mr. Pengelly."†

The results of the exploration led Sir Charles Lyell to state, at the meeting of the British Association for the Advancement of Science in 1859, as follows:—"The facts recently brought to light during the systematic investigation of the Brixham Cave must, I think, have prepared you to admit that scepticism in regard to the cave evidence in favour of the antiquity of man had previously been pushed to an extreme."‡

And Mr. Prestwich, writing in the same year, says: "It was not until I had myself witnessed the conditions under which these flint implements had been found at Brixham that I became fully impressed with the validity of the doubts thrown on the previously prevailing opinions with respect to such remains in caves."§

Dr. Falconer appears to have been so convinced by the Brixham evidence that he specially visited Abbeville to inspect the so-called flint implements collected by Boucher de Perthes from the gravel-beds of the Valley of the Somme, whose discoveries had hitherto been ignored or treated with derision; and he was thus led to adopt the opinion that the Somme

* These relics are now, 1874, in the possession of the Geological Society.
—ED.

† *Antiquity of Man* (1st ed. p. 98).

‡ *Report of British Association*, p. 93.

§ *Philosophical Transactions*, p. 280.

“hatchets” had really been fashioned by the hand of man, and he urged Mr. Prestwich by letter thoroughly to explore the geology of this valley. This he accomplished, in company with Mr. Evans, and the result of their survey led them also to believe that the chipped flints found in the gravel with the bones of the extinct animals were manufactured tools, and that man was, therefore, contemporaneous with the mammoth and other extinct mammalia.

Thus, Brixham Cave is said to have become famous as first furnishing the evidence which dispelled former doubts, stimulated future research, and prepared the way for the adoption of the opinions of that enthusiastic antiquary Boucher de Perthes, that some of the roughly-chipped flints of the drift-beds were fashioned by human hands.

So much stress has been laid on the evidence derived from the exploration of this cave—such strong statements were early put forward of the human manufacture of the exhumed flints—that I resolved to make a careful survey of this cavern, and of its surroundings, and to test the bearing of its evidence on the antiquity of man. Accordingly, I have lately visited the Cavern on three several occasions, made a ground-plan of its different chambers, examined the remaining portions of its beds, and the composition of the drifted gravel; and, in addition, made a searching survey of the geology of the neighbourhood: and further, through the courtesy of a Fellow of the Geological Society, I have had an opportunity of inspecting some of the exhumed bones and flints lodged in the Society’s rooms at Somerset House. The general result of my investigations tends to show; that all the facts of the case have not yet been made known; that some have been wrongly interpreted; that the so-called flint knives, on which the evidence of man’s presence rests, are simply subsoil flakes, and that there is no proof whatever that they are manufactured tools.

The Cavern itself (represented by the dark portions of the plan on page 215) has been naturally formed along the lines of the jointed structure of the limestone rock; this is not only obvious from an inspection of its interior, but it is found by the compass that the direction of the chambers within the cave corresponds with the course of the joints in the adjoining limestone quarry. These joints run nearly N. and S., and E. and W., by the compass, the variation being 21° west. These natural divisional planes have been eroded and enlarged by water to a width of from 4 to 8 feet, and in this manner the chambers of the cave have been formed, and there is no evidence and no pretence that man has in any manner excavated or modified any portion of it so as to render it fit for his habitation.

The deposits in the cave were as follows :—

- “ 1st. At the top, a layer of stalagmite, varying in thickness from one to fifteen inches, which sometimes contained bones, as a reindeer’s horn, and an entire humerus of the cave bear.
- “ 2nd. Next below, loam or bone-earth, of an ochreous-red colour, from one foot to fifteen feet in thickness.
- “ 3rd. At the bottom of all, gravel with many rounded pebbles in it, probed in many places to the depth of twenty feet, without its being pierced through, and as it was barren of fossils, left for the most part unremoved.” (*Ant. of Man*, 1st ed., p. 99.)

The more important bones of mammalia obtained from the bone-earth consisted of the mammoth, the woolly rhinoceros, the cave bear, the cave hyæna, the cave lion, the reindeer, a species of horse, ox, and several rodents.

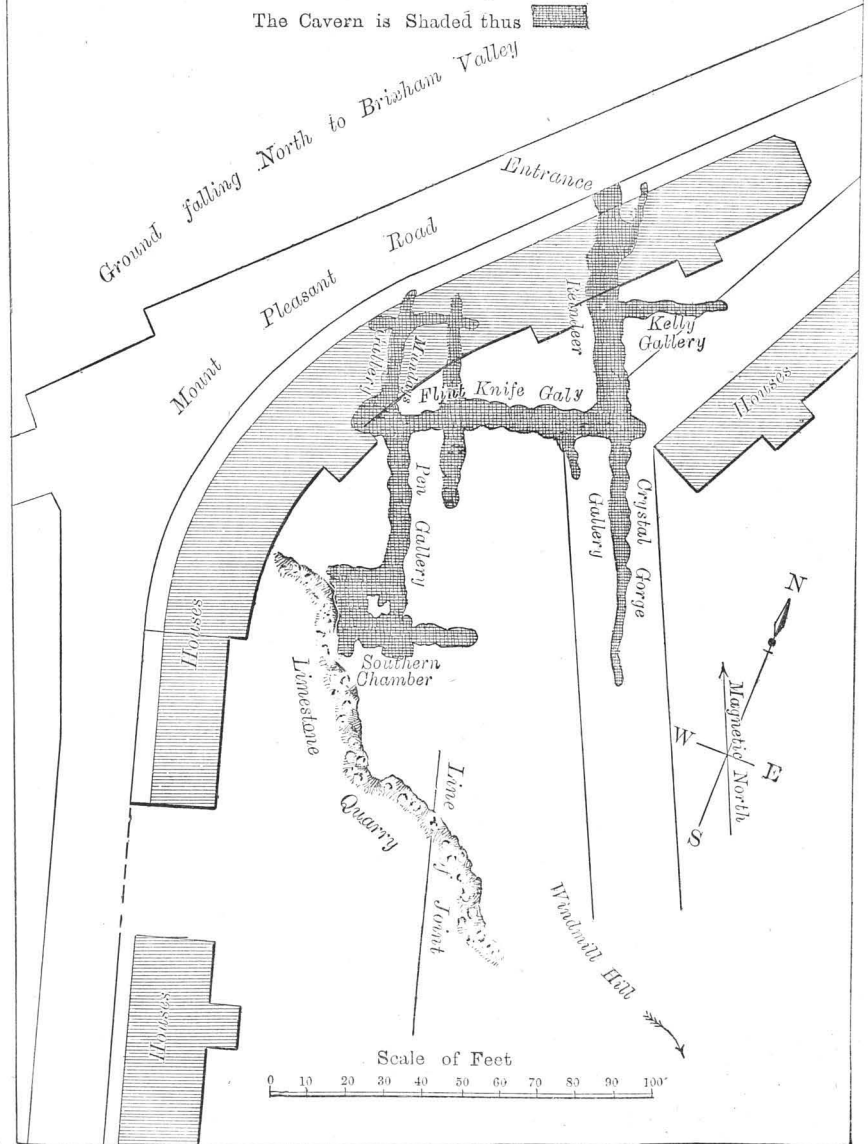
The evidence of the presence of man is founded on the assumed flint implements, and on these alone, which are thus described by Sir Charles Lyell :—“ No human bones were obtained anywhere during these excavations, but many flint knives, chiefly from the lowest part of the bone-earth ; and one of the most perfect lay at a depth of thirteen feet from the surface, and was covered by bone-earth of that thickness. From a similar position was taken one of those siliceous nuclei, or cores, from which flint flakes had been struck off on every side. Neglecting the less perfect specimens, some of which were met with even in the lowest gravel, about fifteen knives, recognized as being artificially formed by the most experienced antiquaries, were taken from the bone-earth, and usually from near the bottom. Such knives, considered apart from the associated mammalia, afford in themselves no safe criterion of antiquity, as they might belong to any part of the age of stone, similar tools being sometimes met with in tumuli posterior in date to the era of the introduction of bronze. But the anteriority of those at Brixham to the extinct animals is demonstrated not only by the occurrence at one point in overlying stalagmite of the bone of a cave bear, but also by the discovery at the same level in the bone-earth, and in close proximity to a very perfect tool, of the entire left hind leg of a cave bear.” (*Ant. of Man*, 1st ed., p. 100.)

Mr. Pengelly, F.R.S., gives a somewhat more detailed account of the relative position of the bones and the flint flakes. He says :—“ Upwards of thirty implements and flakes of flint were found ; the greater number in the cave-earth, and the rest in the gravel below. Not only were they all beneath the stalag-

GROUND PLAN OF BRIXHAM CAVERN.

by N Whitley.

The Cavern is Shaded thus



mitic floor, but they were all from nine inches to upwards of twenty feet below its nether surface; whilst nearly forty per cent. of all the bones met with in the Cavern were above the uppermost implement or flake. Taken as a whole, the implement zone was lower than that of the bones." (*The Ancient Cave-Men of Devonshire*, p. 5.)

From these descriptions it will be seen that the evidence of the presence of man rests only on the "flint knives," a flint core, and some imperfect flint flakes. Now it is obvious that the so-called knives are only ordinary flint-flakes, and Sir John Lubbock describes them as such in his account of this cavern;* and he further says in explanation, "Flakes might be used as knives—they are indeed so named by some archæologists—but it seems to me more convenient to call them simply flakes." † But to call these splinters of flint from Brixham Cavern "flint knives," ‡ "flint implements," § "manufactured tools," § and "relics of man," || is to put words in the place of arguments, and to decide the vital point of the case by an assumption of authority, without even the shadow of any proof.

You will not fail also to observe that in the work entitled *The Geological Evidences of the Antiquity of Man*, no evidence whatever of a geological nature has been adduced as to the origin of the knives, but the burden of proof rests on an antiquarian fancy. Had geological evidence of the origin of the flints been sought, it would have been forthcoming, but thus far it has been either overlooked or ignored.

I have, however, made a searching investigation of the surface geology of the ground adjoining the Cavern, in the expectation of finding some clue which would lead me up to the source of at least some of its contents; and in this expectation I was not disappointed, for I found similar shattered flints in the section of the soil exposed in the low cliff on the east of Brixham harbour. On the top of the table-land of Berry Head, where the soil has been so weathered off that the bare limestone protrudes at the surface, from the crevices of the rock I gathered pebbles of drift gravel, flint flakes, and nodules of iron ore. The subsoil of Windmill Hill above the Cavern yielded me two typical flint cores showing the loss of flakes from their sides. Southward to Sharpham Point I obtained several flint flakes, and three feet under the surface of the soil I found *in situ* a very symmetrical "scraper." And sparingly scattered over the

* *Pre-historic Times*, p. 260.

† *Antiquity of Man*, 1st ed., p. 100.

‡ *The Geologist*, vol. iv. p. 154.

† *Ibid.*, p. 67.

§ *Ibid.*, p. 101.

whole of this table-land is a trail of drift gravel composed of pebbles of quartz, trap, and hæmatite iron ore, which may be also traced down the slopes of the hill to the valley below.

Viewed from this new aspect of the case, it is highly probable that the flakes and the gravel of the Cavern have been derived from this trail of drift, and this probability becomes almost a matter of certainty when we consider that the flakes are associated with the same kind of gravel and nodules of iron ore, both on the outside and the inside of the Cavern.

I will further confirm this connection by an example easy of access, and open to daylight inspection. The limestone of the Hoe, the public promenade at Plymouth, is geologically the same as that of Brixham; at the south-east corner of the Hoe, near the flagstaff, it forms an inland cliff, where a fissure from one to three feet wide extends vertically the full height of the face of the cliff, which is about thirty feet. This fissure is filled to the top with loam and drift pebbles, and a trail of similar pebbles is found scattered over the surface of the rock above the cliff, showing an absolute connection between the drift gravel on the surface and in the fissure.

Thus we obtain the most complete evidence which the nature of the case admits, that the shattered flints found in the Brixham Cavern were derived from the trail of drift on the table-land above, and were washed into the Cavern with the loam and gravel in which they were found; and that the so-called "flint knives" are only subsoil flakes, which may be found by thousands scattered through the soil in various parts of Devon and Cornwall.

Here, however, a further question arises. What is the origin of these subsoil flakes? In a paper which this society did me the honour to reprint,* I have shown that there is good evidence to prove that these flakes have been formed by natural causes, and that they can be traced backwards along the line of drift to the natural home of the flint in the chalk; and to the arguments there adduced I will only now add, that the relative proportion of flakes found in various caverns corresponds closely with their abundance or paucity in the adjoining districts. Thus in a cretaceous country, like that of the departments of the Dordogne and Charente, they are found by thousands in the caverns. In others, on the line of the flint drift, the flakes become scarce as the caverns are near to or removed from the influence of the drift. This point is well

* See *Journal of Transactions of the Victoria Institute*, vol. viii. p. 6.

illustrated in South Devon. In Kent's Cavern the flaked flints are numbered by hundreds, in Brixham Cavern by tens; and at Oreston, near Plymouth, where no flint drift has been found, no flakes have been obtained from the caverns. In Belgium, from one small cavern, thirty thousand such "implements" have been collected. What would be thought of the sanity of a man who, with a dining-room capable of seating only thirty guests, had provided a supply of thirty thousand knives.

The exploration of Brixham Cavern was commenced in 1858, and completed within one year, and shortly after the conclusiveness of the evidence proving the high antiquity of man, was affirmed and vouched for by names in the front rank of science; but the issue of the final report was unaccountably delayed for fifteen years, and during this period outsiders had no opportunity of testing for themselves the force of the evidence, and when an abstract of it appeared in the Proceedings of the Royal Society in 1872, it but feebly supported the strong statements which had been so early put forward, and which was founded solely on the "Fifteen Knives;" but in the final report these are only mentioned as the "so-called knives," and are included under the subdued terms of "flakes and splinters of flint."

"The Philosophical Transactions of the Royal Society" for the year 1873 contain the full report of the committee, and we here find the thirty-six specimens of flints classed and described in detail. They are thus classed by the reporter, Mr. Prestwich:—"Fifteen of which show unmistakable evidence of having been artificially worked." . . . "There are nine others of which the workmanship is very rude or doubtful, while there are seven which I think show no traces of having been worked at all. In the long interval since their discovery, four specimens have been mislaid."* Nos. 6 and 8 are said to form one specimen, thus making up the full number of thirty-six. We may infer from this description that there is an evident passage in these roughly fractured flints, from that which is assumed to be a perfect implement into the flint broken by natural causes, and even the practised eye of the most accomplished geologist of the age fails to determine the difference between the flint said to be chipped by man, and the flint naturally broken.

A special examination of the flints by Mr. Evans is embodied in the Report. He says :† "Of the fragments of flint of various

* *Trans. of Royal Society*, vol. 163, p. 561.

† *Ibid.*, p. 549.

sizes discovered in the Brixham Cave, nearly all showing, in a greater or less degree, traces of human workmanship upon them, thirty-two have been submitted to me for examination." They are principally flakes, and must therefore include the fifteen flint knives, on which the evidence of man's presence has been so confidently founded. Omitting the fancied evidence of use and wear (afterward examined), they are thus described: "No. 1. Portion of a flake, $2\frac{3}{4}$ inches long and $1\frac{1}{4}$ wide." "No. 4. Broad, irregular-shaped flake, $2\frac{3}{4}$ inches long, and in one part nearly 2 inches wide, but tapering to a rounded point." "No. 5. Broad-ended flake, $2\frac{3}{4}$ inches long." "No. 11. Short fragment of a flake, $1\frac{1}{4}$ inch long and 1 inch wide." "No. 12. Portion of a narrow flake, one edge of which has been lost." "No. 29. Fragment of a large broad flake, showing on its convex face a portion of the original crust of the flint." "? Broad flake, $2\frac{1}{2}$ inches long and about $1\frac{3}{8}$ wide, . . . a portion of the ridge at the butt-end removed, . . . one edge broken off, . . . and the flint itself broken into three pieces."*

Such are the famous "Flint Knives" of Brixham Cavern. They are not only ordinary flakes, but from the description given of them by Mr. Evans, they appear to be the most imperfect, irregular, and fragmentary of their kind, and the judgment revolts from the inference that such contemptible fragments of flint could ever have been manufactured or used as tools by man. The evidence of such flakes breaks down from its utter weakness, and from its being unsupported by any "corroborative adjuncts," † Mr. Evans himself being the witness, for he has recorded his opinion of such testimony in these words:— "It is at all times difficult among a mass of flints to distinguish those flakes formed accidentally by natural causes from those which have been made by the hand of man; an experienced eye will indeed arrive at an approximately correct judgment; but from the causes I have mentioned mere flakes of flint, however analogous to what we know to have been made by human art, can never be accepted as conclusive evidence of the work of man, unless found in sufficient quantities, or under such circumstances, as to prove design in their formation by their number or position." ‡

Thus the facts brought to light by the final report fifteen years after the exploration reduce the evidence of Palæolithic man to the smallest possible proportions even to Palæolithic believers.

Coincident with the issue of the final report on the Cavern

* *Trans. of Royal Society*, vol. 163, p. 549. † *Ibid.*, p. 565.

‡ *The Geologist*, vol. iv. p. 360.

by the Royal Society, which showed how slender was the evidence in support of the knives, an attempt has been made to supplement and strengthen it by the bold assertion that "*the whole of the flints*" (discovered in the cave) present "*signs of human workmanship or use upon them,*" and this is insisted on by Mr. Evans with every variation of language six times in a single page.* Here, then, we have a definite issue to try, for whatever may be the form or rudeness of the implements, if they bear conclusive evidence of use by man, then they undoubtedly prove his contemporaneous existence.

In considering this new aspect of the case, it is important, first, to observe that the evidence of wear on implements now used by man is so plain and obvious that it cannot be mistaken;—a worn-out kitchen knife, a ground-down carpenter's axe, or a chisel used up to a stump—are all familiar things; and the same kind of worn and wasted evidence is stamped on the real flint tools of the Neolithic age. After a detailed review of the stone tools of Scandinavia, Nilsson says, "These facts show that the above-mentioned stone objects have been employed as tools in every-day use, and that they have, while being so used, become worn, resharpened, and broken, and that the fragments have been made into other kinds of tools."† And again he says, "We therefore learn that these axes have become blunted, have been reground and worn, until they were entirely worn out."‡

And still more closely to the point to be proved; some few flint flakes have been found which have been rubbed down smooth to a chisel-like edge at one end; and the Neolithic axes or chisels called celts are worn by rubbing or use to a working edge, and many are wasted in length, like a well-used plough-share: and this known evidence of use on authentic flint tools is so obvious that it cannot be mistaken.

But when we come to examine the nature of the evidence of use, now first put forward by Mr. Evans, we are taken aback to find that it is altogether of a different character, and that not a single flint from the Brixham Cavern bears the same indubitable marks of use as are found on the recognized stone tools of the Neolithic age. It is not even pretended that any such evidence of use is found on the Cavern flakes; but Mr. Evans proceeds by way of experiment to scrape the delicate edge of a flint flake over some hard substance such as bone, and the edge becomes broken and chipped,§ and applying this result to the splinters of flint in Brixham Cavern, he says:—

* *Ancient Stone Implements*, p. 471. † *The Stone Age*, p. 90.
 ‡ *The Stone Age*, p. 66. § *Ancient Stone Implements*, p. 458.

“One of these, two and three-quarters inches long, has been chipped or jagged along one edge, apparently by use, while the broad round end is so much worn away as almost to assume the appearance of a scraper. Most of them bear decided marks, either on their sides or ends, of having been in use as scraping tools.”*

The answer to this kind of evidence is obvious and clear. The flakes struck off at a single blow by the flint-knappers of Brandon often show this jagged edge as the result of the natural fracture, and the side of a gun flint trimmed by one stroke of the hammer presents this appearance of minute chipping. Again, a flake carried forward in a *melée* of gravel, must have its delicate edge broken and chipped in places; most of the subsoil flakes are notched in this manner, and so are the thin edges of the roughly-broken flints found with them; indeed it is so obvious that the jagged edge is the result of natural causes, that MacEnery adduces this point as a mark of distinction between the *rubbed flakes* found in sepulchral urns in the Barrows, and the flakes from the Caverns; he says:—“None of the cavern blades appear to have been *rubbed* or polished, but exhibit *the rough serrated edge of the original fracture.*”†

This jagged edge of the flake naturally results from the manner in which flint fractures. When the conchoidal side of a flake is carefully examined under a glass, it will be seen that segmental wave-markings curve around the bulb of percussion, and, like the undulation of water from the fall of a stone, the crest of the wave is somewhat higher than the trough; and thus, as the wave runs out to the edge of the flake, the greater thickness and strength of the crest produces a point, and the trough forms a notch. It is, of course, only on some flakes that this effect can be observed, as other causes have operated to blunt or break their edges.

Thus, this newly-invented evidence of use is not only altogether different from that impressed on the recognized stone implements, but it is obviously the result of natural causes.

We have now to examine the evidence on which the great antiquity of the “flint knives” found in the gravel and loam of the Cavern has been attempted to be proved. On this point I will give the statement made by Mr. Pengelly at a joint meeting of the Archaeological and Ethnological Societies, on the 19th of February, 1861. I quote from the *Geologist*, the editor of which says: “Mr. Pengelly made such very important remarks on the Brixham Cavern that we give his speech in full.” He said: “There was a remarkable circumstance con-

* *Ancient Stone Implements*, p. 471.

† *Cavern Researches*, p. 70.

nected with some well-rolled and worn nodules of brown hæmatite iron mingled with the flints and bones. The greater part of the town of Brixham stands in a valley running nearly east and west, and about 300 feet wide at bottom. The hill on the north rises from the bottom at an angle of twenty degrees, and reaches the height of one hundred and thirty feet; this hill separates Brixham Valley from Torbay, and near its summit, on the northern or Torbay side, there is a large mass or deposit of brown hæmatite iron, *whence the nodules found in the cave were derived*. The southern hill, known as Windmill Hill, rises from the valley at an angle of twenty-eight degrees, and reaches the same height as the former. The Cavern is situated in the northern or Brixham side of this hill, ninety feet above the sea, and seventy feet above the bottom of the valley immediately below; therefore, if the valley was, at the time of the deposit of these bones, flint implements, and nodules, as deep as it is now, the hæmatite nodules must have crossed the valley at right angles to its length, first descending a slope of twenty degrees, and then ascending another of twenty-eight degrees, a gradient of nearly one in two, before they could have entered the Cavern. Hence it appears certain either that the valley could not then have existed, or that it had been filled up with gravel, which had since been cleared out. In either case the bones and flint implements would be of such great antiquity as is consistent with the subsequent reduction by natural causes of the valley to its present physical configuration.”*

This elaborate argument, clear in its details and dogmatic in its assertions, is founded wholly on mistaken observation; it assumes that the hæmatite nodules found in the Cavern must have been derived from the northern hill, that the Brixham Valley has been excavated since their passage across the now eroded ground, and that the antiquity of man, the maker of the flint knives, must, therefore, be measured by the long period of time required for natural causes to excavate the valley seventy-five feet in depth.

This assumption is disproved by a more extended survey of the neighbourhood; for the nodules of iron ore are found scattered through the soil of the hill on the south of the valley as well as on the north; in fact, the largest bulk of iron ore lies on the south, it is so marked on the Ordnance geological map; it has for many years been worked in open excavations, the lease of the mine has been sold and resold at fabulous prices, and these iron nodules, with pebbles of quartz and trap, are

* *The Geologist*, vol. iv. p. 154.

scattered through the soil from Berry Head to Windmill Hill, and may be traced down the slopes of the hill to the valley below.

That these nodules of iron ore in the Cavern are thus a measure of the age of its deposits, and, by further inference, of the great antiquity of man, is opposed to all the surrounding geological evidence.

I have now shown that this Cavern is a natural fracture, unaltered and unused by man; that the celebrated "flint knives" are only ordinary subsoil flakes and splinters of flint, of the most fragmentary and imperfect character; and that similar shattered flints are found in the neighbouring soil; that the traces of human workmanship said to be impressed on the flints are altogether of a different character from that on the known flint tools of the Neolithic age; and that the argument in support of the antiquity of man, based on the presence of the iron nodules in the cave, is completely disproved by a more extended geological survey of the surface formations.

I have thus put facts against fancies—geological evidence against antiquarian assumptions; and I am justified in concluding that this Cavern furnishes no satisfactory evidence of the existence of Palæolithic man—no chronological scale by which to estimate the date of his early appearance.

APOCRYPHAL RELICS OF MAN, SAID TO HAVE BEEN FOUND IN THE
BRIXHAM CAVERN.

In his *Geological Evidences of the Antiquity of Man*, at page 100, Sir Charles Lyell mentions the finding, deep in the bone-earth, of "one of those siliceous nuclei, or cores, from which flint flakes had been struck off on every side"; leading to the inference that flint knives had been made in the Cavern. But, strangely, this important flint is in no way mentioned in the Report of the Committee. From the table, at page 494 of the Report, it does not appear to be one of the four missing flints. It is, therefore, very probable that this core forms one of the parts of the spear-shaped "implement" figured at page 550; and which is further perfected in form in the drawing by an imaginary line restoring about a fourth part of the butt end, assumed to be lost. If this be so, the piece of flint which has done duty as a rejected "core" the past fifteen years, is now elevated to the honour of being the chief part of a spear-head of the "Amiens type."

"The portion of a cylindrical pin, or rod of ivory," is a very apocryphal relic; it is first mentioned by Mr. Evans in his *Stone Implements*, page 471, without any indication as to the bed in which it was found; it is referred to in the Report only in a parenthesis in the same loose manner; and is dismissed by the reporter, Mr. Prestwich, with the suggestive remark, "The position of this is not certain" (p. 564).

The "remarkably symmetrical scraper," figured by Mr. Evans in *Stone Implements* (fig. 412), as being found in the Cavern, "has since been found to be a surface specimen placed amongst the others by mistake." (The Report, p. 551.)

The Chairman* having conveyed the thanks of the meeting to Mr. Whitley,—

Mr. WHITLEY—who exhibited a collection of geological specimens to illustrate the paper—said, that for the last eight or ten years, as a civil engineer, he had had opportunities of observing shattered flints throughout the South of England, from the Scilly Islands to Norfolk, and from Belgium to the southern provinces of France. As to the flints which he now exhibited, some were from the subsoil, and some were struck off by Blake's stone-crusher, both sets, of course, consisting of selected specimens. The flints from the stone-crusher had received their present shape undesignedly and unintellectually, being crushed by simple pressure in Blake's machine, but from them it was very easy to pick out some admirable specimens of flint flakes, cores, scrapers, and knives; precisely similar to those subsoil "flint implements" said to have been formed by the hand of man. The flint flakes, some of which were beautiful examples of the so-called Palæolithic arrow-heads, were scattered by thousands over parts of Devonshire and Cornwall.

Mr. W. S. MITCHELL said it was easy to understand how flints would get fractured in a crushing-machine, but he wanted to know how the subsoil flints had become fractured.

Mr. WHITLEY said he was not able to say positively what power had produced the form in which the subsoil flints were found, but there could be no doubt that at one time England was as cold and icy a region as Greenland is now, and covered with an enormous mass of moving ice, which would exert even a greater force upon the stones beneath it, than the most powerful stone-crusher of modern times. It was remarkable that in the common land cultivated by the miners in Cornwall the same geological formation was found, and in the subsoil there was a layer of crushed quartz mixed up with the crushed flints. Now, no one would contend that the quartz was crushed by man, and it was evident that the same power which crushed the quartz had also crushed the flints. Of course he could not say what happened ten thousand years ago, but it was generally admitted that glacial action had crushed the stones on the surface of the earth.

Mr. MITCHELL still thought the operation of glacial action would be different from that of a stone-crusher. He supposed the stone-crusher acted by percussion?

Mr. WHITLEY said that was not so: the action of the stone-crusher arose from simple pressure, without percussion.

The CHAIRMAN remarked that the operation of the stone-crusher might be very aptly compared to the action of a moving glacier.

Mr. WHITLEY said that he had seen very good flakes produced by a cart-wheel travelling over a flint, and, of course, there was no sudden blow in that case: it was simple pressure without percussion. Some twenty years ago it

* C. Brooke, Esq., F.R.S., V.P.

was observed by Dr. Mantell, in the Isle of Wight, that most of the flints were crushed *in situ*, and he (Mr. Whitley) had himself taken out of a chalk-pit near Eastbourne, eight feet from the surface, a flint shattered *in situ*, which, when dug out, fell to pieces in his hand, and gave him three beautiful cores, which, looked as though flakes had been struck from off them.

The CHAIRMAN said the flint flakes were exceedingly different in character from the unquestionable flints of the Neolithic age. He had seen the finest collection of Neolithic flints in the world, at Copenhagen, where there were 600 or 700 hammer-heads and as many gouges and chisels of flint, the chisels having flat and the gouges curved edges, and there was also a collection of rounded stones which had evidently been used for sharpening the gouges; there could be no question that such implements had been made by the hand of man, but the stones which formed the subject of the present paper were of a totally different character.

Mr. J. T. FRAME mentioned that there was a very fine collection of stone implements exhibited at Salisbury, and along with them was a collection of modern flint implements manufactured by that clever imposter, "Flint Jack."

Mr. J. RENDALL mentioned that Sir Charles Lyell, in one of his books, quoted Professor Ramsay as saying, with reference to the flints found in France, that after twenty years' experience in such matters he was convinced they were manufactured by man. He (Mr. Rendall) was at a loss to know on what evidence that conclusion was formed.

Mr. WHITLEY said he had been three times to see the flints in the valley of the Somme, and the flint hatchets were so abundant that he brought away thirty in a hamper, and any one could get as many as he chose. It was certainly true that many of them were so symmetrical as to present an appearance of artificial work; but these could be traced down through every grade of form to that of rough gravel.

Mr. J. JEREMIAH wished to know if Mr. Whitley inferred an argument against the alleged antiquity of man, notwithstanding all the evidence hitherto published in favour of such a theory. As to the flint flakes, if they were not made by man, how came they to be so often accepted by scientific men as of human origin? Such flakes had been found along with the sculptured tusks and bones of animals. In Kent's Cave, where Mr. Pengelly had found a bone needle under stalagmite, there was a well-known boss which bore the date 1688, and when that was described in the last century, it was covered with a film of limestone, which film had not perceptibly increased in thickness since then. Assuming the date to have been incised in 1688, and the rate at which the limestone deposit accumulated so small, was it possible to doubt the great antiquity of man, when, beneath the floor of the cave, remains had been found which had been accepted by all archæologists as of human origin? Whether man was contemporaneous with the mammoth and the cave bear in this country or not, it appeared certain that he was in France.

Captain F. PETRIE said that, amongst others, Professor T. Rupert Jones, the editor of that valuable work on the Archæology and Palæontology of Southern

France, *Reliquiæ Aquitanicæ*, held that man was not coeval with those animals which were now more generally known to us by their fossils; as to the rate at which stalagmite was formed, Mr. Evans, President of the Geological Society, had stated that "the rate of deposit of stalagmitic matter varies so much with different conditions, that its thickness affords no true criterion of the length of time during which it has accumulated."* In Kent's Cavern the rate of the deposit of stony carbonate of lime—in other words, stalagmitic matter—had been very slow of late; but this was under present conditions; under others it might have been very rapid. For instance; in the Carrara district, in Italy, the stalagmitic deposits were made a source of livelihood among the inhabitants, for the water was in many places so impregnated that any object upon which it fell became thickly coated in a fortnight, and the inhabitants formed brooches and other ornaments in this way.

Mr. WHITLEY said his paper only dealt with the things found in the Brixham Cavern, and not with what had been found in other caves. As to the rate at which stalagmitic matter was deposited, it varied so greatly, that in culverts which he had made he had seen stalagmite formed an inch in thickness and stalactites six inches in length.

Mr. T. K. CALLARD said that even if it were proved that the flints were the work of man, that would not be any proof of man's great antiquity. The resemblance between the flints broken by man and those which were fractured without man's interference, arose from the natural fracture of the flint which made it break in a particular way. As to the so-called palæolithic arrow and spear-heads, there was no evidence to show that they had ever been attached to shafts for offensive purposes, and without that evidence no tenable theory could be deduced from them. If he found a basket full of carpenters' tools in a cave, it would prove nothing as to the antiquity of man. With regard to the inscription "1688" in Kent's Cave,† very much depended on the position of that inscription; it

* *Ancient Stone Implements*, p. 432.

† Dr. J. W. Dawson, F.R.S., in his *Story of the Earth and Man*, p. 304, says, in regard to Kent's cave:—"The somewhat extensive and ramifying cavern of Kent's Hole is an irregular excavation, evidently due partly to the fissures in limestone rock, and partly to the erosive action of water enlarging such fissures into chambers and galleries. At what time it was originally cut we do not know, but it must have existed as a cavern at the close of the Pliocene or beginning of the Post-pliocene period, since which time it has been receiving a series of deposits which have quite filled up some of its smaller branches.

"First and lowest, according to Mr. Pengelly, is a 'breccia,' or mass of broken and rounded stones, with hardened red clay filling the interstices. Most of the stones are of the rock which forms the roof and walls of the cave, but many, especially the rounded ones, are from more distant parts of the surrounding country. In this mass, the depth of which is unknown, are numerous bones, all of one kind of animal, the cave bear, a creature which seems to have lived in Western Europe from the close of the Pliocene down to the modern period. It must have been one of the earliest and most

should also be remembered that there was evidence to show that at one time there were large forests in that neighbourhood, and the decaying vegetation would supply a large amount of carbonic acid which would act as a solvent, and produce stalagmitic matter at a very rapid rate. But the same conditions did not exist now, and it was not to be argued, because it now took 200 years to form a deposit one-eighth of an inch thick, that the formation of every other eighth of an inch had also taken 200 years. As to the bone needle which had been referred to, that was found near the surface, among some coins, and nobody imagined the coins were thousands of years old. He was not sure whether even the evidence of extinct mammalia should

permanent tenants of Kent's Hole at a time when its lower chambers were still filled with water. Next above the breccia is a floor of 'stalagmite,' or stony carbonate of lime, deposited from the drippings of the roof, and in some places three feet thick. This also contains bones of the cave-bear, deposited when there was less access of water to the cavern. Mr. Pengelly infers the existence of man at this time from a single flint flake and a single flint chip found in these beds; but mere flakes and chips of flint are too often natural to warrant such a conclusion.

"After the old stalagmite floor above mentioned was formed, the cave again received deposits of muddy water and stones; but now a change occurs in the remains embedded. This stony clay or 'cave-earth,' has yielded an immense quantity of teeth and bones, including those of the elephant, rhinoceros, horse, hyena, cave-bear, reindeer, and Irish elk. With these were found weapons of chip flint, and harpoons, needles, and bodkins of bone, precisely similar to those of the North American Indians and other rude races. The 'cave-earth' is four feet or more in thickness. It is not stratified, and contains many fallen fragments of rock, rounded stones, and broken pieces of stalagmite. It also has patches of the excrement of hyenas, which the explorers suppose to indicate the temporary residence of these animals; and in one spot, near the top, is a limited layer of burnt wood, with remains which indicate the cooking and eating of repasts of animal food by man. It is clear that when this bed was formed the cavern was liable to be inundated with muddy water, carrying stones and other heavy objects, and breaking up in places the old stalagmite floor. One of the most puzzling features, especially to those who take an exclusively uniformitarian view, is, that the entrance of water-borne mud and stones implies a level of the bottom of the water in the neighbouring valleys of about 100 feet above its present height. The cave-earth is covered by a second crust of stalagmite, less dense and thick than that below, and containing only a few bones, which are of the same general character with those below, but include a fragment of the human jaw with teeth. Evidently, when this stalagmite was formed, the influx of water-borne materials had ceased, or nearly so; but whether the animals previously occupying the country still continued in it, or only accidental bones, &c., were introduced into the cave or lifted from the bed below, does not appear.

"The next bed marks a new change. It is a layer of black mould from three to ten inches thick. Its microscopic structure does not seem to have been examined; but it is probably a forest soil, introduced by growth, by water, by wind, and by ingress of animals, at a time when the cave was nearly in its present state, and the surrounding country densely wooded. This bed contains bones of animals, all of them modern, and works of art ranging from

be accepted as proving a great antiquity, unless archæologists could say when those mammalia became extinct. The dodo was now extinct, but if he found one beside the skeleton of a man, it might only prove that the dodo was contemporaneous with modern times.

Professor TENNANT also bore testimony to the great rapidity with which stalagmitic matter was deposited under certain conditions. In the cave at Matlock birds' nests and chancellors' wigs were petrified by being put into the water, and ten wigs, which had belonged to Lord Eldon, were petrified in a couple of years. (Laughter.) In many districts in England, and especially in the north, spouts carrying water from mines were choked up in two or three years. In the British Museum there was a table, presented by the Duke of Rutland, made from the four sides of a spout. The aperture of the spout was originally one foot square, but it was reduced to four inches by five years' deposits.

Mr. TYLER thought the evidence shown by the existence of the sculptured tusks and bones of mammoths was very strongly in favour of the great antiquity of man, but, of course, its value must depend on the age in which

the old British times before the Roman invasion up to the porter-bottles and dropped halfpence of modern visitors. Lastly, in and upon the black mould are many fallen blocks from the roof of the cave.

"There can be no doubt that this cave and the neighbouring one of Brixham have done very much to impress the minds of British geologists with ideas of the great antiquity of man, and they have, more than other post-glacial monuments, shown the persistence of some animals, now extinct, up to the human age. Of precise data for determining time, they have, however, given nothing. The only measures which seem to have been applied, namely, the rate of growth of stalagmite and the rate of erosion of the neighbouring valleys, are, from the very sequence of the deposits, obviously worthless; the only apparently available constant measure, namely, the fall of blocks from the roof, seems not yet to have been applied. We are therefore quite uncertain as to the number of centuries involved in the filling of this cave, and must remain so until a surer system of calculation is adopted. We may, however, attempt to sketch the series of events which it indicates.

"The animals found in Kent's Hole are all 'Post-glacial.' They therefore inhabited the country after it rose from the great Glacial submergence. Perhaps the first colonists of the coasts of Devonshire in this period were the cave bears, migrating on floating ice, and subsisting, like the Arctic bear, and the black bears of Anticosti, on fish, and on the garbage cast up by the sea. They found Kent's Hole a sea-side cavern, with perhaps some of its galleries still full of water, and filling with breccia, with which the bones of dead bears became mixed. As the land rose, these creatures for the most part betook themselves to lower levels, and in process of time the cavern stood upon a hill-side, perhaps several hundreds of feet above the sea; and the mountain torrents, their beds not yet emptied of glacial detritus, washed into it stones and mud and carcasses of animals of many species which had now swarmed across the planes elevated out of the sea, and multiplied in the land. This was the time of the cave-earth; and before its deposit was completed, though how long before, a confused and often-disturbed bed of this kind cannot tell, man himself seems to have been added to the inhabitants of the British land," &c.

the mammoth lived. In one case he understood the head of a mammoth had been discovered transfixed by a flint arrow-head.

Mr. DIBDIN asked the foundation for that statement.

Mr. WHITLEY remarked that the statement showed how necessary it was to be careful and accurate ; it was so far correct as that an arrow-head was declared to have been discovered embedded in the head of a reindeer, not the head of a mammoth.*

The Meeting was then adjourned.

* See "Nilsson on the Stone Age," p. 171. It has been stated both by Mr. Drake and Professor Ansted, that a flint implement was found entangled in the horns of a stag (a reindeer) at Brixham ; but this has been disproved by Mr. Pengelly.—*The Geologist*, vol. iv. p. 288.—N. W.